Europe, yet some useful information can be drawn from the experiments. The vortex rings of smoke and air fired from the special tubes designed by Steiger and Suschnig at Windisch-Feistritz in southern Styria are very beautiful examples of hydrodynamic phenomena. When the vortex rings are shot vertically upward they, of course, enlarge their diameter and dimensions, while the velocity diminishes, falling to about one-half at the end of the first second, or at an altitude of about 60 or 70 meters, and they finally come to rest at an altitude whose extreme limit is about 350 meters, or 1000 feet, for the largest cannon and the heaviest charge (180 grams) of gunpowder. As the hail falls from much higher elevations than this, we see at once that the smoke vortex can not have a direct action upon it, either mechanical or physical, and we certainly ought not to invoke any mysterious acoustic action following in the line of the ancient myths to the effect that the ringing of bells and the noise of brass bands dissipates lightning and hail.

Dr. E. Vidal proposed to substitute for cannon a form of skyrocket which is guaranteed to reach 500 meters where a charge of 100 grams of powder can be exploded. These cost much less than the cannon, are simpler and less dangerous. If the cannon do any good, these should do better. They are employed only in some portions of France. In general, Angot shows that a more complete investigation of thunderstorms in all their details must be made in order to demonstrate that cannonading or noises have even the slightest effect. A vote was taken by the members of the conference at Graz, concerning which he says that in this vote the vineyardists were generally in favor of shooting as a means of protection, while the scientific men stood out in a very heavy majority against it. At the close of the conference the members visited Windisch-Feistritz and witnessed the cannonading, but, notwithstanding the ardent conviction with which Mr. Steiger explained his ideas, this exposition was far from producing a favorable effect upon the majority of those present. One could not fail to be impressed with the extreme disproportion between the power of the thunderstorm and the weakness of the means employed to combat it.

After some years of infatuation, the question of cannonading against hail seems now to have arrived at a period of calm and rational discussion. The doubt and scepticism that scientists have shown since the beginning have not diminished, but, on the other hand, have increased among the practical farmers and planters.

PASSAGE OF SOUND THROUGH THE ATMOSPHERE.

Under the above title, Prof. C. V. Boys delivered an instructive lecture before the Royal Meteorological Society on March 18, 1903, and we quote the following from the Quarterly Journal for July:

> In consequence of the gradual decrease of density in the atmosphere upward, light does not travel in a straight horizontal line, but is usually curved to the extent of about one-sixth of the curvature of the earth; in other words, it describes a curve in a vertical plane of about 24,000 miles radius. Thus it is that when the sun and moon have just set geometrically they appear just above the horizon. * * * If the ground is very cold and the temperature increases rapidly upward, a diminution of density becomes intensified and light travels in a still more curved path. * * * When the conditions are reversed, and cold air is resting on warm ground, it sometimes happens that the change of density is sufficiently rapid to cause the beam of light to gradually curve the other way and a mirage results. * * * Unlike light, the velocity of sound is not affected by the density of the air, but it is by the temperature. As, therefore, the temperature usually falls with increasing altitude, the usual condition is that sound travels more quickly near the ground than higher up. This will especially be the case on a warm, quiet, sunny day. If, therefore, on such an occasion it were to happen that the air were uniformly stratified in layers of decreasing temperature, sound would not travel in straight lines, but in curved lines, with the concavity upward. One person, therefore, could not be heard well by another at a distance. * * * On the other hand a quiet night, with the ground colder than the air, tends to reverse the curvature of the sound waves, so that the ground does not form an obstruction and sound is heard well. Above all, a gentle wind, imperceptible on the ground, but increasing gradually upward, adds its velocity to the sound velocity one way and subtracts it to the other, and so *up* the wind, the resultant velocity becomes less upward, and sound rays are strongly bent so as to be concave upward and the ground intercepts all the sound. *Down* the wind, on the other hand, the velocity is greater upward, and rays starting possibly at a number of different inclinations from a source of sound may, after some miles, all converge on a listener, and so he may observe acoustical looming to the amazing extent that we sometimes experience.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and VI.

The mean monthly pressure was highest over the Ohio Valley and Tennessee, east Gulf States, and the southern portion of the South Atlantic States, where the values ranged from 30.05 to 30.09 inches. Over the middle and southern Plateau regions the mean pressure was less than 29.90 inches, with a minimum mean of 29.75 inches at Yuma, Ariz.

The mean pressure for the month was above the normal in the Atlantic and Gulf States, Ohio Valley and Tennessee, lower Lake region, southern portion of the upper Lake region, the upper Mississippi and lower Missouri valleys, southern North Dakota, and the middle and southern slope, and southern portion of the northern slope regions, with the maximum departures ranging from + .05 to + .08 inch over southeastern Florida, the extreme southern portions of Alabama, Mississippi, and Louisiana, southeastern Texas, southern Missouri, northeastern Arkansas, the northern portions of Mississippi and Alabama, western Tennessee, southwestern Virginia, and West Virginia.

Over the Pacific and Plateau regions and the northern portion of North Dakota the mean pressure was below the normal, with the greatest departure over southeastern and northwestern Montana, northern Idaho, eastern and central Washington, north-central California, and north-central Utah, where the departures averaged from — .05 to — .06 inch.

The mean pressure increased over that of June, 1904, in the districts to the southward of a line drawn from the mouth of Chesapeake Bay northwestward to central North Dakota, thence southward to New Mexico, and thence westward to the Pacific Ocean just to the northward of San Francisco. To the northward of this line the mean pressure diminished from that of the preceding month.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart V.

The mean temperature for the month was slightly above the normal on the Massachusetts coast, and in northwestern Montana, northern Idaho, and Washington, except along the coast and in the extreme southeastern portion. In all other sections the mean temperature was below the normal, the greatest changes occurring generally over the central districts, and the southern Plateau, with maximum departures of —4.0° in north-central Nebraska, and —4.1° in central North Dakota.

Maximum temperatures of 90°, or higher, occurred except in portions of New England, North Dakota, the immediate Pacific coast, and the mountain regions; of 100°, or higher, in the central portions of South Carolina, Georgia, Alabama, and Mississippi, Oklahoma, north-central and portions of the Rio

Grande Valley of Texas, southern New Mexico, southern and western Arizona, and interior California, portions of southeastern Washington, eastern Oregon, western Idaho, western Kansas, and southeastern Colorado; and 110°, or higher, in western Arizona and southeastern California.

Freezing temperatures were reported from portions of western Wyoming, eastern Nevada, and upper Michigan.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	67.4	— 0.7	—14.4	— 2.1
Middle Atlantic	12	73.5	— 1.0	—15.8	— 2.3
South Atlantic	10	78.4	— 0.7	—11.5	— 1.6
Florida Peninsula*	8	80.6	— 0.8	+ 1.5	+ 0.2
East Gulf	9	78.7	— 2.0	— 6.8	— 1.0
West Gulf	7	80.0	— 1.9	+ 2.3	+ 0.3
Ohio Valley and Tennessee	11	74.5	— 1.8	—15.7	— 2.2
Lower Lake	8	69.9	— 1.3	—18.7	— 2.7
Upper Lake	10	66.2	— 1.4	—19.4	— 2.8
North Dakota*	8	65.2	— 3.0	—19.0	— 2.7
Upper Mississippi Valley	11	72.3	— 2.9	—19.8	— 2.8
Missouri Valley	11	72.5	— 2.7	— 8.7	— 1.2
Northern Slope	7	67.9	— 1.6	+ 2.2	+ 0.3
Middle Slope	6	74.5	— 1.5	+ 3.8	+ 0.5
Southern Slope*	6	79.5	— 0.1	+ 9.7	+ 1.4
Southern Plateau*	13	75.8	— 2.2	+ 5.0	+ 0.7
Middle Plateau*	8	70.2	— 1.5	+ 2.3	+ 0.3
Northern Plateau*	12	68.6	+ 0.2	+12.7	+ 1.8
North Pacific	7	60.8	— 0.5	— 0.6	— 0.1
Middle Pacific	5	63.6	— 0.9	+ 2.4	+ 0.3
South Pacific	4	69.8	— 0.9	+ 3.9	+ 0.6

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The temperature was above the average throughout the Maritime Provinces, likewise in Quebec, except in the extreme western portion. It was average, or a little above, from the Okanagan Valley in British Columbia eastward to western Assiniboia, embracing southern Alberta; elsewhere in the Dominion the average was not maintained, the negative departures differing little, and the general deficiency being from 1° to 3°. The chief positive departures occurred in the eastern parts of Quebec and the Maritime Provinces and amounted to from 3° to 5°.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The distribution of precipitation was rather irregular. Over southeastern Georgia there was an excess of over 7 inches, over 4 inches in south-central Kansas, and over 2 inches in north-central New York, southeastern Minnesota, western Iowa, central Nebraska, southwestern Mississippi, southeastern Louisiana, and western Florida. Deficiencies of 2 inches, or slightly more, occurred over the western portion of the Peninsula of Florida, northern Georgia, northwestern South Carolina, southeastern Tennessee, southwestern Virginia, the central and upper Ohio Valley, northeastern Iowa, southwestern Minnesota, central Oklahoma, north-central New Mexico, and portions of southern New England.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 3, 4, 13, 18, 20. Arizona, 25, 26, 28–31. Arkansas, 17, 26. California, 8, 10. Colorado, 1–7, 10, 12, 18, 20, 21, 23, 28, 29, 31. Connecticut, 18, 28. Delaware, 16, 28. District of Columbia, 7. Florida, 2, 3, 18. Georgia, 3, 18, 21, 25, 27. Idaho, 3, 5, 7, 12, 15, 29. Illinois, 1, 6, 11, 12, 14, 15, 20, 22, 23, 27. Indiana, 1, 8, 21, 24. Iowa, 10–14, 17–19, 26, 29. Kansas, 2–6, 8–10, 14, 15, 21, 27. Kentucky, 8, 10, 17, 24, 26, 27. Louisiana, 1, 19. Maine, 2, 29. Maryland, 11, 16, 26, 31. Massachusetts, 2, 5, 16. Michigan, 14, 15, 21–23, 26, 27. Minnesota, 8, 10, 21, 25. Mississippi, 2, 7, 16, 19, 22, 30. Missouri, 11, 12, 15, 21, 27. Montana, 3, 9, 11–13, 27, 28. Nebraska, 1, 4–6, 9, 11, 13, 14, 20, 25–29. Nevada, 8, 23, 30, 31. New Hampshire, 2. New Jersey, 1, 11, 16, 19, 28. New Mexico, 1, 2, 12, 15, 16, 18, 19, 23, 27, 28, 30, 31. New York, 1, 15, 17, 27. North Carolina, 5, 8, 12, 21, 25, 26. North Dakota, 13, 17, 25, 29. Ohio, 1, 6, 17, 18, 19, 22, 25, 27, 28. Oklahoma, 4, 6, 7. Oregon, 8, 10, 11, 15, 21. Pennsylvania, 1, 11, 15, 18, 19, 26. South Carolina, 2, 6, 8, 17, 21, 25, 27, 29–31. South Dakota, 10, 12, 13, 19, 20, 24, 25. Tennessee, 1, 3, 4, 14, 19, 27. Texas, 2, 12. Utah, 1, 5–7, 12, 21, 23, 28, 29. Vermont, 28. Virginia, 1, 7, 8, 11, 12, 16, 19. Washington, 3, 6, 7, 11. West Virginia, 1, 18–20, 22. Wisconsin, 11, 18, 20, 21, 26. Wyoming, 2–5, 8–10, 12, 20–22, 26.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	2.33	64	—1.3	— 2.0
Middle Atlantic	12	4.25	100	0.0	— 5.4
South Atlantic	10	5.57	93	—0.4	— 8.4
Florida Peninsula*	8	5.02	77	—1.5	— 1.2
East Gulf	9	6.12	111	+0.6	—12.4
West Gulf	7	3.00	100	0.0	— 3.8
Ohio Valley and Tennessee	11	2.84	69	—1.3	— 5.8
Lower Lake	8	4.05	129	+0.9	+ 2.1
Upper Lake	10	2.80	93	—0.2	— 1.4
North Dakota*	8	1.76	71	—0.7	+ 0.6
Upper Mississippi Valley	11	4.00	108	+0.3	— 1.4
Missouri Valley	11	4.13	111	+0.4	+ 0.6
Northern Slope	7	1.80	106	+0.1	+ 0.4
Middle Slope	6	3.00	103	+0.1	+ 3.0
Southern Slope*	6	1.74	55	—1.4	+ 0.3
Southern Plateau*	13	1.23	86	—0.2	— 2.4
Middle Plateau*	8	0.77	135	+0.2	+ 2.0
Northern Plateau*	12	1.02	142	+0.3	+ 0.2
North Pacific	7	0.94	112	+0.1	+ 0.6
Middle Pacific	5	0.18	225	+0.1	+ 4.6
South Pacific	4	T.	100	0.0	— 0.5

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The rainfall was above the average over the eastern portion of the Northwest Territories and in Manitoba; also in Ontario east of Lake Huron, north to the Nipissing district and east to an imaginary line drawn north and south from the eastern end of Lake Ontario. In all the remaining portions of the Dominion the average was not maintained, except in one or two isolated cases, such as St. John, N. B., and Victoria, B. C., where it was four-tenths of an inch and one-tenth of an inch above the average, respectively, Welland recorded the highest rainfall for the month, 5.90 inches, this being 2.94 inches in excess of the average; Winnipeg and Toronto closely followed with 5.55 inches and 5.15 inches, respectively.

HUMIDITY.

The relative humidity was normal in the Middle Atlantic and west Gulf States, upper Lake region, and southern Plateau and north Pacific districts; below normal in the South Atlantic States, Florida Peninsula, and North Dakota, and above normal in the remaining districts.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	82	+ 2	Missouri Valley	69	+ 3
Middle Atlantic	74	0	Northern Slope	58	+ 6
South Atlantic	78	— 2	Middle Slope	66	+ 6
Florida Peninsula	78	— 2	Southern Slope	60	+ 1
East Gulf	78	0	Southern Plateau	38	0
West Gulf	77	+ 3	Middle Plateau	39	+ 9
Ohio Valley and Tennessee	72	+ 3	Northern Plateau	48	+ 7
Lower Lake	73	+ 4	North Pacific	75	0
Upper Lake	72	0	Middle Pacific	64	+ 2
North Dakota	62	— 4	South Pacific	67	+ 3
Upper Mississippi Valley	71	+ 3			

CLEAR SKY AND CLOUDINESS.

The distribution of clear sky is graphically shown on Chart IV, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The cloudiness was normal in the middle slope region; below normal in the Florida Peninsula, North Dakota, Missouri Valley, and northern slope, southern Plateau, and south Pacific districts. In the remaining districts it was above normal, but neither the positive nor negative departures were very marked.

The average cloudiness for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.4	+ 0.5	Missouri Valley	4.2	— 0.2
Middle Atlantic	5.2	+ 0.4	Northern Slope	3.6	— 0.2
South Atlantic	5.3	+ 0.3	Middle Slope	4.0	0.0
Florida Peninsula	4.7	— 0.3	Southern Slope	4.2	+ 0.4
East Gulf	5.8	+ 0.8	Southern Plateau	3.0	— 0.3
West Gulf	4.3	+ 0.1	Middle Plateau	2.8	+ 0.8
Ohio Valley and Tennessee	4.8	+ 0.2	Northern Plateau	3.9	+ 0.8
Lower Lake	5.0	+ 0.5	North Pacific	5.0	+ 0.6
Upper Lake	5.0	+ 0.3	Middle Pacific	4.0	+ 0.3
North Dakota	3.6	— 0.7	South Pacific	2.3	— 0.4
Upper Mississippi Valley	4.7	+ 0.4			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 9378 thunderstorms were received during the current month as against 8193 in 1903 and 8502 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 5th, 490; 11th, 452; 7th, 442; 6, 417.

Reports were most numerous from: Ohio, 482; Nebraska, 454; Missouri, 388; Florida, 373; New York, 364; Illinois, 357.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the dates of full moon, viz, July 23 to 31, inclusive.

In Canada: Thunderstorms were reported from Sydney, 20; Halifax, 10, 20; Grand Manan, 1, 12, 20; Yarmouth, 2; Charlottetown, 20, 21; Quebec, 1, 11, 12, 16, 19, 26–29; Montreal, 12, 19, 28, 31; Ottawa, 1, 5; Kingston, 5, 9, 12, 18; Toronto, 12, 28, 31; White River, 12, 15; Port Stanley, 1, 4, 5, 9, 12, 17–19, 21–23, 28, 31; Saugeen, 17, 26; Parry Sound, 9, 12, 15, 18, 24, 27, 31; Port Arthur, 11, 17, 18, 20, 21; Winnipeg, 2, 9, 17–20, 24, 29; Minnedosa, 2, 11, 14, 18, 29; Qu'Appelle, 12, 13, 16, 28–30; Medicine Hat, 10, 15, 16, 29; Swift Current, 12, 15, 28, 29; Calgary, 7; Banff, 11, 22; Prince Albert, 1, 10, 15, 16, 18, 24; Barkerville, 4, 26; Port Simpson, 26.

Auroras were reported from Halifax, 9; Father Point, 6; Minnedosa, 7; Swift Current, 5, 6; Prince Albert, 6; Battleford, 6.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	7	52	nw.	Point Reyes Light, Cal.	3	57	nw.
Columbus, Ohio	18	50	sw.	Do	4	52	nw.
Hatteras, N. C	19	60	n.	Do	15	50	nw.
Lewiston, Idaho	28	50	w.	Do	16	63	nw.
Modena, Utah	15	51	sw.	Do	17	58	nw.
Mount Tamalpais, Cal.	7	50	nw.	Do	18	50	nw.
Do	14	54	nw.	Do	27	62	nw.
Do	28	59	nw.	Do	28	58	nw.
North Head, Wash.	14	53	se.	St. Louis, Mo	11	55	w.
Do	16	62	se.	Yellowstone Park, Wyo.	14	52	sw.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

For description of tables and charts see page 136 of REVIEW for March, 1904.